

### **REMARKS**

Applicants thank the Examiner for the thorough examination given the present application.

#### **Status of the Claims**

Claims 1-2 and 20-31 are pending in the above-identified application. Claim 20 is currently withdrawn from consideration, and claims 1-2 and 21-31 stand ready for further action on the merits. Upon allowance of the elected claims, Applicants respectfully request that claim 20 be rejoined. Claims 3-19 are cancelled herein. Support for the amendments to claims 1-2 can be found in the present specification, *inter alia*, at page 9, lines 14-17. Claims 22-31 are added. Support for new claims 22 and 25 can be found in the present specification, *inter alia*, at page 9, lines 26-27. Support for new claim 23 can be found in the present specification, *inter alia*, at page 14, lines 6-11. Support for new claim 24 can be found in the present specification, *inter alia*, at page 14, lines 22-23. Support for new claim 26 can be found in the present specification, *inter alia*, at page 10, lines 2-3. Support for new claim 27 can be found in the present specification, *inter alia*, at page 12, lines 2-3. Support for new claims 28 and 30 can be found in the present specification, *inter alia*, at page 14, line 27 to page 15, line 1. Support for new claims 29 and 31 can be found in the present specification, *inter alia*, at page 15, lines 9-10. Thus, no new matter has been added. Based upon the above considerations, entry of the present amendment is respectfully requested.

In view of the following remarks, Applicants respectfully request that the Examiner withdraw all rejections and allow the currently pending claims.

#### **Statement of the Substance of the Interview**

Applicants thank the Examiner for his time during the interview on June 29, 2009. Applicants' Representative appreciates the courtesies extended to him in this application. In compliance with MPEP 713.04, Applicants submit the following remarks.

The Interview Summary sufficiently summarizes the discussions during the interview. Although an agreement could not be reached, Applicants believe that the claims are now in condition for allowance. Should the Examiner believe that there remains any outstanding issues, Applicants respectfully request that the Examiner contact Applicants' Representative so as to expedite resolution of these outstanding issues, via an Examiner's Amendment or the like.

**Issues under 35 U.S.C. § 103(a)**

Claims 1, 2, and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Awano '507 (US 7,084,507) in view of Webster (Wiley Encyclopedia of Electrical and Electronics Engineering). Applicants respectfully traverse. Reconsideration and withdrawal of this rejection are respectfully requested.

**Legal Standard for Determining Prima Facie Obviousness**

MPEP 2141 sets forth the guidelines in determining obviousness. First, the Examiner has to take into account the factual inquiries set forth in *Graham v. John Deere*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), which has provided the controlling framework for an obviousness analysis. The four *Graham* factors are:

- (a) determining the scope and content of the prior art;
- (b) ascertaining the differences between the prior art and the claims in issue;
- (c) resolving the level of ordinary skill in the pertinent art; and
- (d) evaluating any evidence of secondary considerations.

*Graham v. John Deere*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966).

Second, the Examiner has to provide some rationale for determining obviousness. MPEP 2143 sets forth some rationales that were established in the recent decision of *KSR International Co. v Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

As the MPEP directs, all claim limitations must be considered in view of the cited prior art in order to establish a *prima facie* case of obviousness. See MPEP 2143.03.

*Distinctions over the Cited References*

Amended claims 1 and 2 recite that the carbon nanotube comprises 6-membered carbon rings. Therefore, as recited, the present invention employs a substrate having 6-membered carbon rings for both the carbon nanotube and the organic material. The overlapping of the atomic orbital between the adjacent multi-bonded atoms, known as conjugated atoms, enables charge transfer through the terminal. Specifically, the carbon nanotube disposed between the metal and organic material remarkably improves electric conductivity (page 25, line 23 to page 26, line 3).

Furthermore, the Examiner continues to assert that Awano '507 discloses device formation of a wiring structure including a metal and an intervening carbon nanotube. However, the Examiner admits that Awano '507 fails to disclose the use of a semiconductor material in which the device component includes an organic semiconductor material having a 6-membered carbon ring. The Examiner relies on Webster in an attempt to overcome this deficiency.

According to MPEP 2143.01, the combination of references cannot render the reference inoperable for its intended purpose. As evidenced by the Rule 132 Declaration previously submitted with the Response of December 2, 2008, it is impossible to replace substrate 202 of Awano '507 with an organic material having a 6-membered carbon ring. As discussed in the Declaration, it is not possible to grow a carbon nanotube on a substrate of an organic material having a 6-membered carbon ring because the sublimation temperature of an organic material having a 6-membered carbon ring is much lower than the growth temperature of the carbon nanotube. Specifically, carbon nanotubes require an approximate temperature of 400°C in order to grow. In stark contrast, organic materials having 6-membered carbon rings have a sublimation temperature of approximately 200°C to 300°C.

Thus, if one skilled in the art attempted to grow a carbon nanotube on a substrate of an organic material having a 6-membered carbon ring, the substrate would decompose or sublime before growth is completed. Decomposition or sublimation would occur regardless of the carbon nanotube growth method employed, including the method disclosed by Awano '507.

In the outstanding Office Action, the Examiner asserts that this Declaration was not persuasive. Thus, enclosed herewith is additional evidence showing that (i) carbon nanotubes require a temperature of 400°C in order to grow and (ii) organic materials having 6-membered carbon rings have a sublimation temperature of 200-300°C. First, the enclosed Handbook of Nano Carbon with its partial translation shows that the lowest temperature for growing a multilayer carbon nanotube is 400°C. Second, the enclosed Oja et al. reference (J. Chem. Eng. Data 1998, 43, 486-492) provides Table 4 at page 490, which shows a variety of organic materials having 6-membered carbon rings having a sublimation temperature of 565 K or less (that is, 291°C or less). Thus, the substrate 202 of Awano '507 cannot be replaced with an organic material having a 6-membered carbon ring since the organic material would sublime before a temperature could be reached which would form carbon nanotubes.

During the interview, the Examiner requested further explanation as to why the present invention works when the combination of the cited references does not. The present invention works and the combination of the cited reference is inoperable due to the differences between the present invention and Awano '507 with respect to the formation process. In the present invention, the carbon nanotube is grown on the metal, and then, the organic material is provided on the carbon nanotube (see the examples of the present specification, especially pages 17, 20, and 23). In Awano '507, the carbon nanotube is formed on the semiconductor, and then, the electrode is formed. Therefore, even if the semiconductor is replaced with an organic material, it is impossible to make carbon nanotubes grow on the organic material. In other words, the metal is not damaged by heating at 400°C or more, but the organic material would be. Therefore, the present invention is operable since nanotubes are grown on the metal, but modified Awano '507 is inoperable due to the heat required to grow the nanotubes on the organic material. Thus, a *prima facie* case of obviousness has not been established, and withdrawal of the outstanding rejection is respectfully requested.

#### **New Claims 22-31**

Applicants newly add claims 22-31 in an effort to further define the scope of protection owed to Applicants. Applicants respectfully submit that claims 22-30 are allowable for the

reasons given above.

With regard to claim 22, the carbon nanotube has higher electroconductivity than the organic material having a 6-membered carbon ring. Awano '507 discloses that the inner nanotube has semiconductor-like characteristics (col. 17, lines 50-52). In the present invention, the organic material can work as a channel. Therefore, the carbon nanotube having higher electroconductivity than the organic material having a 6-membered ring does not have semiconductor-like characteristics. Thus, the carbon nanotube of claim 23 is different from Awano '507 in this respect.

Regarding claim 23, the metal and the carbon nanotube form the electrode. In Awano '507, the carbon nanotube does not work as an electrode. Awano '507 discloses the electrode in Figure 19. Therefore, one of ordinary skill in the art would have no reason or rationale to use the metal and the carbon nanotube as an electrode.

With respect to claim 24, the distance between the metal and the organic material having a 6-membered carbon ring is 1 to 10  $\mu\text{m}$ . In Figure 19 of Awano '507, such a distance corresponds to the total thickness of layers 214, 212, 210, 208, and 206. Each thickness of layers 214, 212, 208, and 206 is 50 nm (col. 17). Though the thickness of layer 201 is unclear, it seems to be about 50 nm from Figure 19 in Awano '507. Thus, the distance in Figure 19 of Awano '507 is about 250 nm, which is much smaller than the distance recited in claim 25. Furthermore, one of ordinary skill in the art would have no reason or rationale to lengthen the distance in Awano '507.

As such, Applicants respectfully assert that claims 22-31 clearly define over the cited references, and an early action to this effect is earnestly solicited.

**CONCLUSION**

A full and complete response has been made to all issues as cited in the Office Action. Applicants respectfully request that a timely Notice of Allowance issue for the present case clearly indicating that each of claims 1-2 and 21-31 are allowed and patentable under the provisions of title 35 of the United States Code.


Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Chad M. Rink, Reg. No. 58,258 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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Attachments: Handbook of Nano Carbon with partial translation  
Oja et al., J. Chem. Eng. Data 1998, 43, 486-492.